

Application No.: 10/806559
Docket No.: AD7001USNA

Page 2

In the Specification

Please amend the paragraph bridging pages 1 and 2 as follows:

It is generally known in the art and an accepted commercial practice to modify asphalt sold for paving applications by the addition of various polymers. Typically polymer additives are employed to improve rut resistance, fatigue resistance, and cracking resistance and sometimes to improve stripping resistance from the aggregate. These improvements tend to result from or correlate to increases in asphalt elasticity and stiffness upon addition of the polymer. Asphalts for paving are performance graded by a set of SHRP (Strategic Highway Research Program) specifications. For example, a PG58-34 asphalt should provide good rut resistance at 58°C and good cracking resistance at -34°C. The addition of the polymer to the asphalt is known to significantly increase the first number (i.e., provides higher temperature rut resistance) and significantly improve fatigue resistance. The improvements in rut and fatigue resistance result from increases in stiffness and elasticity. In commercial applications, these increases are to be accomplished with relatively small amounts of polymer (i.e., 1 to 5 weight percent polymer). However, such small amounts of polymer do not sufficiently improve the low temperature properties to meet acceptable performance grades [I] , although the properties are somewhat improved-some). Thus, good low temperature properties for asphalts are mainly obtained by addition of oils such as gas oil. Currently, the commercial polymer modified asphalt (PMA) market is dominated by the use of styrene/butadiene/styrene (SBS) type block copolymer additives. Typically the asphalt industry considers polymers for asphalt modification to be either categorically an elastomer or a plastomer. The term plastomer carries a negative connotation in that a plastomer lacks elastomeric properties. However, plastomers are sometimes used to modify asphalt because they can increase stiffness and viscosity which improves rut resistance but they are generally considered inferior to elastomers due to lack of significant improvements in fatigue resistance, creep resistance, cold crack resistance and the like. SBS polymer is considered an elastomer. There are mixed feelings in the industry as to how to categorize some polymeric asphalt additives.

Application No.: 10/806559
Docket No.: AD7001USNA

Page 3

Please amend the paragraph bridging pages 1 and 2 as follows:

In U. S. Pat. Nos. 5,306,700 and 5,556,900, PMA compositions useful in road paving and roofing applications are disclosed. These compositions include involving a reactive polymeric asphalt additive that chemically reacts and links to the asphalt as a result of the presence of an epoxy functional group. The reactive polymer additive is an ethylene copolymer of the general formula E/X/Y/Z where E represents the ethylene derived unit and constitutes from 20 to 99.5 wt% of the copolymer. The X can be present up to 50 wt% and is derived from, for example, alkyl acrylates, alkyl methacrylates, vinyl esters, and or alkyl vinyl ethers. The Y is present in from 0.5 to 15 wt% and is to be derived from [[:]] for example, glycidyl acrylate, glycidyl methacrylate or glycidyl vinyl ether. The Z is optionally present up to 15 wt% and is derived from other ~~monomer monomers~~ such as carbon monoxide, sulfur dioxide, acrylonitrile and the like. Of particular note is the reactive terpolymer ethylene/n-butyl acrylate/glycidyl methacrylate (EnBAGMA), which is known (after chemical linking to the asphalt) to significantly improve both elasticity and stiffness of the resulting PMA, much like elastomeric asphalt additive.

Please replace the paragraph on page 3 from lines 10 to 30 with the following:

In U.S. Pat. Nos. 6,117,926 and 6,399,680, improved PMA compositions are taught wherein an asphalt and a stiffness-enhancing copolymer having available epoxy groups are reacted in the presence of an effective amount of an acid (e.g., H₃PO₄ and H₂SO₄) to promote chemical bonding between the asphalt and the available epoxy groups of the copolymer. The use of the acid is shown to minimize the amount of epoxy functionalized polymer additive (generally the most expensive component) required to achieve greater stiffness values over similar reaction times relative to no acid being present. The references also acknowledge that low temperature SHRP performance grades are attained by the addition of processing oils and additionally ethylene

Application No.: 10/806559
Docket No.: AD7001USNA

Page 4

copolymers including specifically ethylene vinyl acetate (EVA), ethylene methyl acrylate (EMA), ethylene n-butyl acrylate (EnBA), and ethylene ethyl acrylate (EEA) copolymers may be blended with the polymer to achieve (unspecified) suitable results. ~~In a pair of~~ U.S. Pat. Nos. 6,011,095 and 6,414,056 exemplify the specific use of polyphosphoric acid (PPA) and/or superphosphoric acid (SPA) as the acid adjuvant in the promotion of the chemical bonding between asphalt and the available epoxy groups of ethylene/methyl acrylate/glycidyl methacrylate terpolymer (EMAGMA) and ethylene/n-butyl acrylate/glycidyl methacrylate terpolymer (EnBAGMA) ~~are exemplified,~~ respectively.

Please replace the paragraph bridging pages 6 and 7 with the following:

The tubular reactor produced ethylene/alkyl acrylate copolymer useful in the present invention is an ethylene copolymer derived from the copolymerization of ethylene monomer and at least one additional alkyl acrylate or alkyl methacrylate comonomer, wherein the alkyl group contains from 1 to 8 carbon atoms. More specifically, the tubular reactor produced ethylene/alkyl acrylate copolymer according to the instant invention is to be distinguished from a more conventional autoclave produced ethylene/alkyl acrylate as generally known in the art. Thus the term or phrase "tubular reactor produced" ethylene /alkyl acrylate copolymer, for purposes of this invention, denotes an ethylene copolymer produced at high pressure and elevated temperature in a tubular reactor or the like, wherein the inherent consequences of dissimilar reaction kinetics for the respective ethylene and alkyl acrylate comonomers is alleviated or partially compensated by the intentional introduction of the monomers along the reaction flow path within the tubular reactor. As generally recognized in the art, such a tubular reactor copolymerization technique will produce a copolymer having a greater relative degree of ~~heterogeneity~~ homogeneity along the polymer backbone (a more random distribution of comonomers), will tend to reduce the presence of long chain branching and will produce a copolymer characterized by a higher melting point

AUG. 4. 2006 7:55PM

NO. 4407 P. 7

Application No.: 10/806559
Docket No.: AD7001USNA

Page 5

than one produces at the same comonomer ratio in a high pressure stirred autoclave reactor.

Application No.: 10/806559
Docket No.: AD7001USNA

Page 6

Please replace the paragraph bridging pages 12 and 13 with the following:

In preparing the PMA compositions found in the various runs of the examples, 500 gram samples were mixed at 190°C for 3 hours in open cans utilizing a conventional paddle mixer. The 3 hours proved sufficient to obtain a homogeneous blend of the polymer in the asphalt. In measuring the dynamic shear rheometer values (DSR), a sinusoidal test that determines both the elastic and viscous components of PMA, test specification defined by TP5 of AASHTO was employed. The measurement was ~~performed~~ performed at a cycle time ~~rate~~ of 10 radians per second. This is generally representative of the time for one cycle of loading due to 55 mph traffic. The test ~~sorts out~~ separates the contribution of the elastic and viscous components of the complex modulus G^* . The value of $G^*/\sin \delta$ (defined in the Tables) must be 1 or above at the expected maximum pavement temperature (average 7 day maximum) on the original sample and 2.2 on the RTFO (i.e., rolling thin film oven, 163°C (325°F), 85 minutes, ASTM 2872-97) sample. The RTFO simulates short-term aging from hot mixing and construction. Elastic recovery of bituminous material by ductilometer is a measure of asphalt elasticity and was run at either 25°C or 10°C on the original sample and/or on the RTFO sample. A molded specimen was elongated at a rate of 5 cm/min to a total length of 10 cm and then cut and the percent recovery ~~is~~ was measured (ASTM D6084-97).